Rise Of Technology In The 21st Century: China Study Case

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ABSTRACT

Throughout the years, China has developed into a superpower country with the world's second-largest economy. Of course, China's economic policymaking process has undergone many changes from the past to the present. A high-quality economy requires several key driving factors, such as sufficient and sustainable investment in human capital and mastery of technology. In the 21st century, China has achieved excellent economic performance, and its role in the international market has attracted global attention. Thanks to their advanced technology, China has dominated the global market by utilizing their progress in marketing electric vehicles and even the use of artificial intelligence which is widely used today. This research using secondary data from 2020 to 2025. The research focuses on how China can be consistent in using the basic tools and materials used in the manufacture of electric vehicles so that there are more diverse electric car manufacturers. The key indicators analyzed include mastery of the supply chain of key raw materials (such as lithium, nickel, and cobalt), innovation in battery technology, and government policies that support the expansion and development of the new energy vehicle industry. The study concludes that China's technological rise in the 21st century has not only impacted domestic progress, but also shifted the dynamics of global competition in technology, economics, and geopolitics.

Keywords: *China, Technology, 21st Century, Electric Vehicles.*

INTRODUCTION

China is one of the world's largest superpower countries, not just in Asia. Although China is a country that has achieved success in its technology and economy, it has not escaped the history it has experienced, which has led it to where it is today. In the 20th century, China underwent various revolutions that disrupted its domestic economic stability. Consequently, China, through its centralized leadership, sought to modernize its economy and implement pragmatic policies. In the post-Mao Zedong era, China began to emerge as an economic power open to international cooperation (Wishanti, 2014). This openness is also accompanied by the gradual introduction of democratic elements into the governance of international relations.

In its quest to achieve its goal of becoming a developed nation, China strives to establish a systematic financial framework and address any emergencies or issues that arise, ensuring that the country's monetary situation cannot be effectively challenged, while simultaneously allowing unknown financial backers to contribute. The reorientation of China's economic policy is strongly influenced by the commitment of policymakers at the central government level. This commitment can be demonstrated by two factors. First, the Chinese government views globalization as an economic

phenomenon that opens up opportunities to maximize profits and increase national economic capacity. Second, globalization can serve as a gateway for China to integrate into international organizations, such as the World Trade Organization (WTO), the International Monetary Fund (IMF), and the World Bank, as well as into the G7, G8, and G20 groups (Yafei, 2017). China is strategically disseminating information about its divided regulatory cycle process and must make fundamental adjustments. This fundamental agreement is influenced by two significant variables: barter and exchange. Bargaining and negotiation are crucial, given that China is a dictatorship. The strategy must be convincing and supported by the nation's leaders, as the cycle will obviously take almost a day and be extensive. The presence of these two factors also facilitates the inclusion of other parties, such as academics, financial experts, think tanks, and others, in the planning process (Maria, 2024). The strategy is also designed to be flexible in its implementation. This policy should be able to be implemented anywhere, given China's vast geography.

In the challenges and obstacles that China faced in the 20th century, it is known that China implemented various globalization measures and reforms to improve its economy. In the 21st century, which has entered a modern era where technological development is very much needed in a country. In recent decades, China has experienced rapid technological advancement, transforming the country from a manufacturing-based economy into a global hub for technological innovation. This success has been driven not only by substantial investment in research and development, but also by proactive government policies and the widespread adoption of digital technologies by society and industry.

The development of technology in China is evident in everyday life around the world, as seen in the use of artificial intelligence (AI), which makes everyday tasks easier. China's AI industry has experienced rapid growth, with an annual growth rate exceeding 10% between 2018 and 2022. The China Academy of Information and Communications Technology (CAICT) reported that the core AI industry's value reached RMB 508 billion (approximately US$75 billion) in 2022, marking an 18% year-over-year increase. Cities like Beijing, Shanghai, and Shenzhen are leading this transformation, leveraging vast markets and diverse sectors (Rathi, 2025). China's long-term AI strategy, supported by adaptive regulations and infrastructure, ensures sustainable growth by integrating AI into key industries such as healthcare, manufacturing, and energy.

In addition to the widespread use of AI, China also dominates the global market for electric vehicles. The use of electric cars is considered efficient and practical in various countries. China, a leader in electric car supply, has dominated the world for several years. China has key companies in the EV sector, such as BYD, NIO, and Xpeng, which are growing rapidly and becoming major players in both domestic and international markets. In China's efforts to increase its productivity in supplying electric cars, it also requires raw materials for electric vehicles, such as nickel, manganese, cobalt (MNC), or lithium ferrous phosphate (LFP). For China's marketing strategy of electric vehicles, LFP or NMC batteries prioritize securing the market first. Like the war of alternative energy between electricity and hydrogen, it is inevitable to find cheaper and more profitable ones. Electric vehicle batteries require specific raw materials

sourced from various parts of the world. The main raw materials are lithium, cobalt, and nickel. China imports nickel from abroad, particularly from Indonesia, to meet the demand for these NMC batteries. Indonesia's rise as a major supplier of nickel for electric vehicle batteries is impressive (Marybeth, 2024). Therefore, Chinese companies are actively investing in nickel mines to ensure a long-term supply.

This paper concludes that China's innovation strategy in technology is gaining ground in global competition across economics, technology, and geopolitics. The big plan for China's industrial future seems very promising on paper. China appears to have a smart and well-thought-out strategy to advance technology in manufacturing. However, the political plan still needs to demonstrate whether it can work effectively in real-life situations. A thorough review of the upcoming implementation documents and industry-specific five-year plans is necessary to gain a better understanding of the direction and outcomes of government policies. With a particular focus on Electric Vehicles and their raw materials in China`s dominance in technology in the 21st century. The aim is to analyze how China's dominance in the use and supply of electric vehicle raw materials, supply chains, innovation, and supportive policies have enabled increased global technological competitiveness.

METHODS

The research method employed in this study is qualitative. The qualitative method involves gathering and analyzing non-numeric data, such as video, audio, and text, to understand concepts, experiences, or opinions related to ongoing research. This approach is used to gather insights into a problem or generate new ideas for research (Bhandari, 2020). In this paper, researchers use this method to collect corresponding data from other sources and then compare the data to gain new results.

According to Moleong (2007), a qualitative method is an analytical approach that produces descriptive data through words or spoken observations. So, it is a method whose conclusions are influenced by all variables. Through this method, the author will examine all data obtained and analyse it systematically (Moleong, 2007). The author aims to explain the use of advanced technology to enhance the strategy. China's goal is to become a leading market competitor in technology production for the interim plan, spanning approximately until the 2030s.

The author focuses this research on explaining how the advanced technology that China possesses can be a critical component in technological advancements and the identification of China's strategy for its technology, such as Electric Vehicles and their raw materials, so that China can gain a competitive advantage. Of course, these initiatives are also supported by government policy and industrial strategy, which aim to set ambitious goals for electric vehicle production and technological leadership.

This research takes references based on secondary data collected between 2020 and 2025 from various industry reports, development policies, and scholarly articles on China's technology . Additionally, secondary data analysis is employed to examine trends, policies, and technological innovations introduced in China during the 21st century.

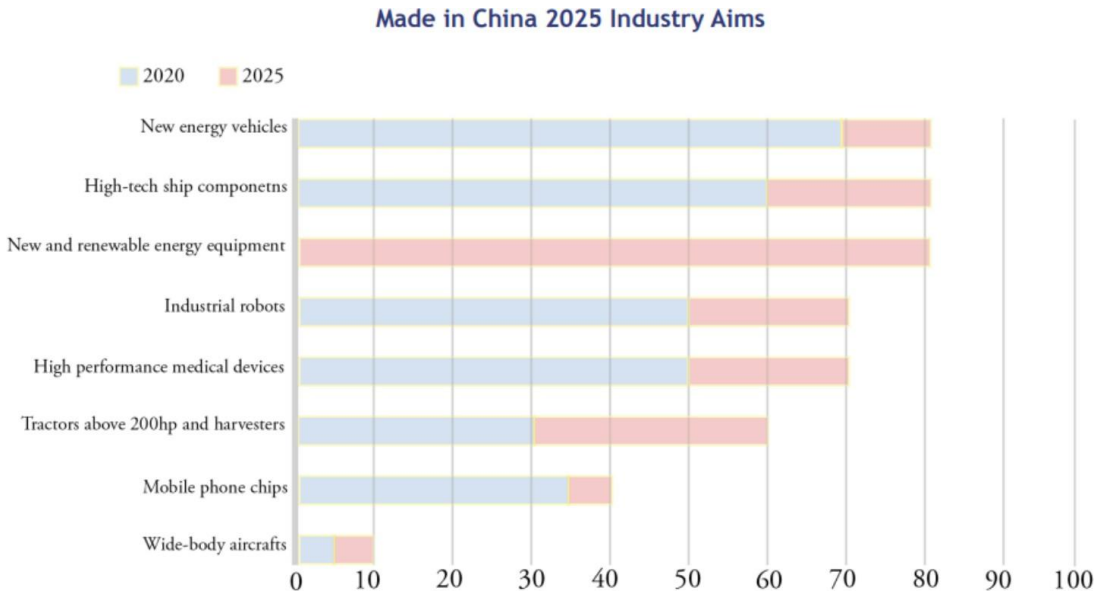
RESULT AND DISCUSSION

As a superpower country in Asia, China needs to maintain its economic value in comparison to other international nations. And in today's economy, every country needs to get creative and take any advantage they get to pursue their international economic growth, and in this research, China pushes all its resources and human resources toward the creation of EVs (electric vehicles) such as electric cars, electric motorcycles, and electric bikes. This sudden growth of electric vehicle products in China didn't come out of nowhere; it was carefully prepared, as China has been the world's largest producer of batteries, according to Electric Car Talk. China possesses most of the world's lithium and other raw materials needed to create batteries for electric vehicles that are about to be produced and exported worldwide. The fact that electric vehicle demand has grown so rapidly up to this year has even led experts to predict that electric vehicles could make up to 50% of new car sales by 2030 (Marybeth, 2024). The rising of China's electric vehicle production not only caused by the rising of electric vehicles demand worldwide but also by the fact that beside becoming the country to produce traditional internal-combustion cars, China didn't have any domestic brands that could rival foreign countries who already dominating the market way long before China start making the traditional internal combustion car, also the research on hybrid vehicles where the battery serve as the secondary role to the gas engine is also being led by countries like Japan means China also can't compete with that either. This prompted the Chinese government to invest in a completely new territory: cars powered entirely by batteries. Although this experiment carried a high risk, back then, electric vehicles were a niche experiment conducted by brands like Toyota and General Motors, which usually ended up being discontinued after just a few years of experimentation. However, the rewards are huge, as China can play a significant role in the auto industry (IEA, 2025). Recognizing this opportunity, the Chinese government aimed to capitalize on it and began investing as early as 2001. That year, electric vehicle technology was established as a key science initiative in China's five-year plan, which is the nation's foremost economic framework. In 2007, the sector received a major boost when Wan Gang, an automotive engineer who had been with Audi in Germany ten years earlier, assumed the role of China's Minister of Science and Technology. Wan Gang was an avid supporter of electric vehicles and had tried Tesla's initial electric vehicle, the Roadster, in 2008, the year it debuted. Currently, individuals in China have recognized Wan Gang for making a significant national choice to invest substantially in electric vehicles. Since that time, electric vehicles have been continuously emphasized in China's national economic strategy (Yang, 2023).

Through state-supported gigafactories and exclusive technology for essential materials, China has effectively created what an industry expert refers to as "nearly a moat" around its battery manufacturing, causing Europe and the United States to rush to keep pace. Moreover, China's strategic transition from Nickel Management Cobalt (NMC) to Lithium Iron Phosphate (LFP) production was not just a choice of materials but a plan for worldwide dominance. Myserdorf mentioned that a planned long-term approach, developed ten years prior, intended to utilize current supply chains, intellectual property, and functioning gigafactories. This insight has led to a worldwide

leadership in LFP manufacturing now. Apart from controlling raw materials, China has advanced LFP chemistry, greatly enhancing efficiency. By allowing the implementation of larger LFP cells, a configuration that is incompatible with NMC due to safety issues. Chinese producers have introduced additional ideas, including BYD's blade battery and the designs known as "cell to pack," "cell to chassis," and "cell to body." (Ahmad, Dahad, Razdan, Valerio, & Ward, 2025).

These advancements remove modules and their related costs, a feature intrinsic to NMC. With L(M)FP batteries providing extended driving ranges that align with customer expectations, certain OEM models are either adopting this chemistry or incorporating it into their lineup for basic models. By 2024, the energy density difference between NMC and LFP cells is approximately 30 percent (which reduces to 5 to 20 percent at the pack level, according to market vehicles). Simultaneously, the production expense of an NMC cell is roughly 20 percent greater than that of an L(M)FP cell in US dollars per kilowatt-hour (kWh), manufactured under identical conditions. In numerous instances, OEMs persist in utilizing NMC batteries in high-end vehicles, as they still provide a greater driving range than LFP, despite the performance difference diminishing. For example, the Tesla Model 3 SR+ features a 55 kWh LFP battery, providing a driving range of around 450 km (WLTP), whereas the LR variant, which has an 82 kWh NMC battery, achieves a range of roughly 630 km (WLTP). Likewise, the latest Xiaomi SU7 comes with an LFP variant boasting a 73 kWh capacity and a 700 km range (CLTC), in addition to a more powerful version featuring a 101 kWh NMC capacity and around 800 km range (CLTC). Although the first supercar featuring an L(M)FP battery was launched in 2024, market trends indicate that cars needing high energy densities for optimal range will continue to use NMC (Möller, 2024).



Source: (Institute for Security & Development Policy, 2018)

In the next step, China has set a new goal for electric vehicle sales in 2025 at 80 million units. Furthermore, this target was set back in 2015, when China presented the plan called "Made in China 2025," which is a goal for China to become the top leader in advanced technological industries. From the very start, it was clearly stated that the focus of the plan is to ensure that quality is the most important factor. The goal was to invest in technological innovation, specifically in smart manufacturing, which focuses on areas such as machine learning and artificial intelligence. It was also stated that the goal was to ensure that the created technology is very difficult to replicate (Delinda, 2024).

China's strategy for dominating the global electric vehicle industry includes funding local assembly facilities, integrating the supply chain, facilitating technology transfers, and providing government assistance to meet transportation demands and address environmental issues, thereby positioning China as a worldwide leader in the electric vehicle sector. In emerging markets throughout Asia, Latin America, and other regions, Chinese electric vehicle manufacturers are offering affordable and diverse electric vehicle options. At the same time, Chinese electric vehicle producers have gained substantial traction in developed Western countries, such as the United States, the United Kingdom, and several European nations, by offering competitive, budget-friendly EV options. Their wide range of products and swift technological progress have appealed to cost-sensitive buyers. These firms frequently enter these markets through regional manufacturing and collaborations to address regulatory hurdles (Gargeyas, 2023).

China's technological advancements benefit both China and the global community. In October 2024, Chinese Foreign Ministry spokesperson Mao Ning stated that, with the new wave of scientific and technological revolution, China is prepared to collaborate with other nations to seek open and inclusive science and technology cooperation, share the benefits of scientific and technological innovation, and collectively tackle global challenges. Indeed, certain individuals in the West are experiencing competitive stress from a fresh surge of Chinese technological progress and are trying to undermine China's tech developments to limit its autonomous innovation. Nevertheless, whether they acknowledge it or not, this increase in advanced technology growth in China is not a temporary trend but is grounded in a strong basis for continuous progress. It will positively impact both China's economy and the global economic environment (Weijia, 2025).

Today, China is known to produce over three-quarters of batteries sold globally, and in 2024, average battery prices dropped faster there than anywhere else in the world, falling by nearly 30%. Batteries in China were reported to be cheaper than in Europe and North America by over 30% and 20%, respectively. Declining battery prices in recent years are a major reason why many electric vehicles in China are now cheaper than their conventional counterparts (IEA, 2025).

Furthermore discussion researcher conclude that China will become next massive electric vehicle producer in the world right next to United States since many China's electric vehicle has become more popular especially in the Southeast Asia

Region where many China's electric vehicle brand gain their popularity due to them being more affordable than United States electric vehicle which more costly due to the branding strategy of the United States electric vehicle manufacturers.

CONCLUSION

China's massive rise in technological development can be seen in various aspects especially in the everyday life of the country's residents themselves where many of the residents prefer using electric vehicle for their main transportation, not only for private/individual uses, but also for public transportation, China has started using electric bus and electric train for their main public transportation since electric vehicle are more environmental friendly and emit less emission to the surroundings environment. The government also played an important role in increasing the productivity of the electric vehicle because it provided all the necessities such as subsidies, tax breaks, procurement contracts, and other policy incentives, and thanks to this support, a batch of homegrown electric vehicle brands have emerged and continued to optimize new technologies so electric vehicle manufacturers can meet the real-life needs of Chinese consumers. This, in turn, has cultivated a large group of young car buyers who are starting to take an interest in local electric vehicles. China's technological advancements in the 21st century take this modern era to a whole new level. China is not only pursuing technological excellence but also strengthening its innovation ecosystem, encompassing economic sustainability, education, and even existing policies, thus accelerating sustainable technological development and technological independence on a global scale.

This study demonstrates that China's technological advancement in the 21st century has been primarily driven by robust government policies that support innovation and high-tech manufacturing. In the electric vehicle sector, China has emerged as a global leader through advancements in battery technology and the mass production of electric vehicles. Furthermore, strategies for managing raw material supply chains, such as those employed by MNCs and LFPs, are being implemented to address geopolitical challenges and raw material limitations. China needs to further optimize the diversification of raw material sources and enhance its security through the exploration of new sources and material recycling. International collaboration is also possible, and in short, an integrated and controlled battery raw material supply chain provides a strong foundation for the rapid growth of China's electric vehicle industry and the sustainability of new energy vehicle technology. With this strategy, China is expected to continue strengthening its position as a major global technological power.

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